

What's the Evidence for the Effectiveness of the BSCS 5E Instructional Model?

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Support from educational research studies for teaching science as inquiry is growing (for example, Geier et al., 2008; Hickey et al., 1999; Lynch et al., 2005; and Minner et al., 2009). A 2007 study, published in the *Journal of Research in Science Teaching* (Wilson et al., 2010), is particularly relevant to the *Evolution and Medicine* supplement.

In 2007, with funding from NIH, BSCS conducted a randomized, controlled trial to assess the effectiveness of the BSCS 5Es. The study used an adaptation of the NIH supplement *Sleep, Sleep Disorders, and Biological Rhythms*, developed by BSCS in 2003 (NIH and BSCS, 2003). Sixty high school students and one teacher participated. The students were randomly assigned to the experimental or the control group. In the experimental group, the teacher used a version of the sleep supplement that was very closely aligned with the theoretical underpinnings of the BSCS 5Es. For the control group, the teacher used a set of lessons based on the science content of the sleep supplement but aligned with the most commonplace instructional strategies found in U.S. science classrooms (as documented by Weiss et al., 2003). Both groups had the same master teacher.

Students taught with the BSCS 5Es and an inquiry-based approach demonstrated significantly higher achievement for a range of important learning goals, especially when the results were adjusted for variance in pretest scores. The results were also consistent across time (both immediately after instruction and four weeks later). Improvements in student learning were particularly strong for measures of student reasoning and argumentation. The chart (Table 7) on the following page highlights some of the study's key findings. The results of the experiment strongly support the effectiveness of teaching with the BSCS 5Es.

Evidence also suggests that the BSCS 5Es are effective in changing students' attitudes on important issues. In a research study conducted during the field test for the NIH curriculum supplement *The Science of Mental Illness* (NIH and BSCS, 2005), BSCS partnered with researchers at the University of Chicago and the National Institute of Mental Health. The study investigated whether a short-term educational experience would change students' attitudes about mental illness. The results showed that after completing the curriculum supplement, students stigmatized mental illness less than they had beforehand. The decrease in stigmatizing attitudes was statistically significant (Corrigan et al., 2007; Watson et al., 2004).

Table 7. Differences in Performance of Students Receiving Inquiry-Based and Commonplace Instructional Approaches

Measure	Mean for Students Receiving Commonplace Teaching	Mean for Students Receiving Inquiry-Based Teaching	Effect Size
Total test score pretest (out of 74)	31.11	29.23	Not applicable
Total test score posttest	42.87	47.12	0.47
Reasoning pretest (fraction of responses at the highest level)	0.04	0.03	Not applicable
Reasoning posttest	0.14	0.27	0.68
Score for articulating a claim (out of 3)	1.58	1.84	0.58
Score for using evidence in an explanation (out of 3)	1.67	2.01	0.74
Score for using reasoning in an explanation (out of 3)	1.57	1.89	0.59

Source: Wilson, C.D., et al. 2010.

Note: Effect size is a convenient way of quantifying the amount of difference between two treatments. This study used the standardized mean difference (the difference in the means divided by the standard deviation, also known as Cohen's *d*). The posttest scores controlled for the variance in students' pretest scores. The reasoning posttest scores controlled for variance in students' reasoning pretest scores at the highest level.

References

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